

## **What is claimed is:**

**[Claim 1]** A method using spent Brewer's or Bakers yeast, fungi, or bacterial cell walls to produce a Beta-(1,3/1,6)-D-glucan, mannan and manno-protein complexes, said method comprising:

- a) stabilization and pretreatment of yeast by pasteurization using steam injection to a temperature of about 100 degree C for 15 to about 30 minutes;
- b) cooling the stabilized, pretreated yeast and separating into liquid and solid phases;
- c) extraction of the solid phase with stirring with a 0.5 N to 5.0 N solution of an alkali-metal or alkali-earth metal hydroxide heated to a temperature of about 45 degree C to about 80 degree C for about 30 minutes in a ratio of about 1:5 to 1: 15 solids to liquid;
- d) increasing the temperature to 95 degree C to about 150 degree C for 15 min to about 120 min at a pressure of 1 psi to about 25 psi;
- e) extracting with water the solid phase separated from solid-liquid phase of d) at a ratio of 1:4 to about 1:20 with mixing for 15 minutes to about 2.5 hours at a temperature range of 20 degree C to about 100 degree C;
- f) pasteurization by steam injection to a temperature of about 100 degree C for 15 to about 30 minutes;
- g) extraction of the solid phase from f) with an acid in a ratio of about 1:4 to about 1:20 solids to acid solution while being heated to a temperature from about 45 degree C to about 120 degree C for 15 minutes to about 2 hours;
- h) extraction with water the solid phase separated from solid-liquid phase of g) at a ratio of 1:4 to about 1:20 with mixing

for 15 minutes to about 2.5 hours at a temperature range of 20 degree C to about 100 degree C ;

- i) pasteurization by steam injection to a temperature of about 100 degree C for 15 to about 30 minutes;
- j) Solids separated from i) will comprise at least 70% Beta (1,3)/(1,6)-D-glucan by dry weight.

**[Claim 2]** The method of claim 1, wherein the yeast is pasteurized using steam injection to a temperature of 100 degree C for 20 minutes.

**[Claim 3]** The method of claim 1, wherein the separation of b) is by centrifugation.

**[Claim 4]** The method of claim 1, wherein the alkali-metal or alkali-earth metal hydroxide is sodium hydroxide.

**[Claim 5]** The method of claim 4, wherein the sodium hydroxide is 1.5 M.

**[Claim 6]** The method of claim 1, wherein the temperature of c and d) was 80.degree. C for 45 minutes and 121 degree C for 30 minutes.

**[Claim 7]** The method of claim 1, wherein a) through d) is repeated 3 times.

**[Claim 8]** The method of claim 7, wherein the mixture is collected and combined.

**[Claim 9]** The method of claim 8, wherein the mixture is left to stand with mixing at ambient temperature.

**[Claim 10]** The method of claim 9, wherein the duration was about 24 hours.

**[Claim 11]** The method of claim 1, wherein the separation in e) was by centrifugation.

**[Claim 12]** The method of claim 1, wherein the water extraction in e) was at a ratio of about 1:5.

**[Claim 13]** The method of claim 1, wherein the water extraction in e) was at a temperature of about 20 degree C.

**[Claim 14]** The method of claim 1, wherein the water extraction in e) duration was about 30 minutes.

**[Claim 15]** The method of claim 1, wherein the water extraction in f) is pasteurized using steam injection to a temperature of 100 degree C for 20 minutes.

**[Claim 16]** The method of claim 1, wherein the separation in f) was by centrifugation.

**[Claim 17]** The method of claim 1, wherein the acid in g) was acetic acid.

**[Claim 18]** The method of claim 17, the acetic acid was about 3%.

**[Claim 19]** The method of claim 1, wherein in g) the duration was about 1 hour.

**[Claim 20]** The method of claim 1, wherein g) through h) is repeated about 3 times.

**[Claim 21]** The method of claim 1, wherein the separation in h) was by centrifugation.

**[Claim 22]** The method of claim 1, wherein the water extraction in h) was at a ratio of about 1:5.

**[Claim 23]** The method of claim 1, wherein the water extraction in h) was at a temperature of about 20 degree C.

**[Claim 24]** The method of claim 1, wherein the water extraction in h) duration was about 30 minutes.

**[Claim 25]** The method of claim 1, wherein the water extraction in i) is pasteurized using steam injection to a temperature of 100 degree C for 20 minutes.

**[Claim 26]** The method of claim 25, wherein was separated by centrifugation.

**[Claim 27]** The method of claim 26, wherein was spray dried.

**[Claim 28]** The method of claim 11, wherein the mannan and manno-protein complexes are obtained from the liquid phase;

- k) the liquid phase of the separation is collected;
- l) the solution's pH is adjusted to 5.0–8.0 with an acid;
- m) the solution is pasteurization by steam injection to a temperature of about 100 degree C for 15 to about 30 minutes;
- n) the mannan and manno-protein complexes are precipitated by alcohol or spray dried.

**[Claim 29]** The method of claim 28, wherein the acid in k) was hydrochloric acid.

**[Claim 30]** The method of claim 28, wherein the pH in k) was about 7.

**[Claim 31]** The method of claim 28, wherein in l) is pasteurized using steam injection to a temperature of 100 degree C for 20 minutes.

**[Claim 32]** The method of claim 28, wherein the solids from n) will comprise at least 30% mannan and manno-protein complexes.

**[Claim 33]** The method of claim 28, wherein the solids from n) will comprise at least 15% protein.

**[Claim 34]** A method that protects and stabilized the (1,3)/(1,6)-D-glucan from micro-biological degradation by the method of claim 1.

**[Claim 35]** Preparation of an animal feed comprising Beta (1,3)/(1,6)-D-glucan prepared by the method of claim 1 in an amount effective for enhancing immuno-competence of the animals.

**[Claim 36]** The animal feed of claim 35, wherein the effective amount is a concentration of the Beta (1,3)/(1,6)-D-glucan in the range from about 5 ppm to about 500 ppm of the feed.

**[Claim 37]** The animal feed of claim 36, wherein the animal fed the feed containing Beta glucan is in the poultry family.

**[Claim 38]** The animal feed of claim 36, wherein the animal fed a feed containing Beta glucan is in the family of swine.

**[Claim 39]** The animal feed of claim 36, wherein the animal fed a feed containing Beta glucan is in the family of horses.

**[Claim 40]** The animal feed of claim 36, wherein the animal fed a feed containing Beta glucan is in the family of cattle.

**[Claim 41]** The animal feed of claim 36, wherein the animal fed the feed containing Beta glucan is in the family of crustacean.

**[Claim 42]** A method for enhancing the immune competence of poultry, said method comprising adding an effective amount of Beta (1,3)/(1,6)-D-glucan produced by the methods in Claim 1 to poultry feed.

**[Claim 43]** The method of claim 42, wherein the effective amount is between 5 ppm and 500 ppm of feed.

**[Claim 44]** The method of claim 43, wherein the effective amount is 20 ppm.

**[Claim 45]** A method for enhancing the immune competence of swine, said method comprising adding an effective amount of Beta (1,3)/(1,6)-D-glucan produced by the methods in Claim 1 to swine feed.

**[Claim 46]** The method of claim 45, wherein the effective amount is from 25 ppm to 300 ppm of feed and more preferably 100 ppm.

**[Claim 47]** The method of claim 45, wherein the effective amount is 80 ppm.

**[Claim 48]** A method for enhancing the immune competence of horses, said method comprising adding an effective amount of Beta (1,3)/(1,6)-D-glucan produced by the methods in Claim 1 to horse feed.

**[Claim 49]** The method of claim 48, wherein the effective amount is from 25 ppm to 300 ppm of feed and more preferably 100 ppm.

**[Claim 50]** The method of claim 48, wherein the effective amount is 60 ppm.

**[Claim 51]** A method for enhancing the immune competence of shrimp, said method comprising adding an effective amount of Beta (1,3)/(1,6)-D-glucan produced by the methods in Claim 1 to shrimp feed.

**[Claim 52]** The method of claim 51, wherein the effective amount is between 35 ppm and 300 ppm.

**[Claim 53]** The method of claim 52, wherein the effective amount is 80 ppm.

**[Claim 54]** A method for enhancing the antibody formation in swine said method comprising adding an effective amount of Beta (1,3)/(1,6)-D-glucan produced by the methods in Claim 1 to feed.

**[Claim 55]** A method for enhancing the antibody formation as well as reducing the negative growth responses usually associated with administering a vaccine.

**[Claim 56]** Preparation of an animal feed comprising Beta (1,3)/(1,6)-D-glucan prepared by the method of claim 1 in an amount effective for enhancing immuno-competence of the animals combined with mannans and mannoproteins prepared by method claim 28, an amount sufficient to inhibit bacterial adhesion to the intestinal walls of livestock and laboratory animals.

**[Claim 57]** The method of claim 26, wherein the Beta glucan is added to the feed at 10 ppm to 200 ppm of feed and the mannans are added at 500 ppm to 4 ppm of feed.